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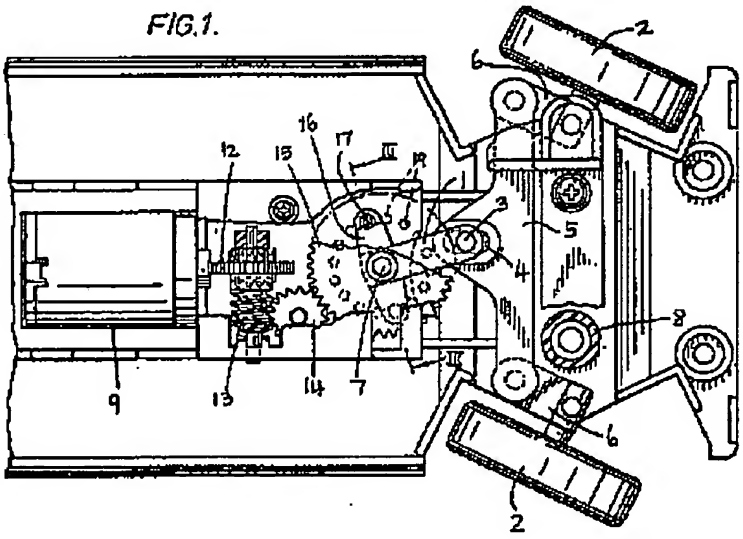
(54) Toy vehicle steering mechanism

(57) A toy vehicle comprises a powered steering mechanism including a steering arm 1 pivotable through a limited arc to steer at least one wheel 2 of the vehicle, and a reversibly drivable rotary transmission member 15 drivingly connected with said steering arm to selectably pivot the same in either direction of steering operation, the driving connection 17,19 between the said transmission member and the said steering arm being such that when the steering arm reaches the limit of its pivotal movement in either direction the said driving connection is automatically disengaged to enable further rotation of the said transmission member without further movement of the steering arm, but is automatically reengaged at least when the direction of rotation of the transmission member is reversed. A reversible motor 9 controlled by cable or radio drives a transmission member 19 provided with recesses 19 which co-operate with protrusions 17 on flexible wings 18 of the steering arm 1.

FIG.1.



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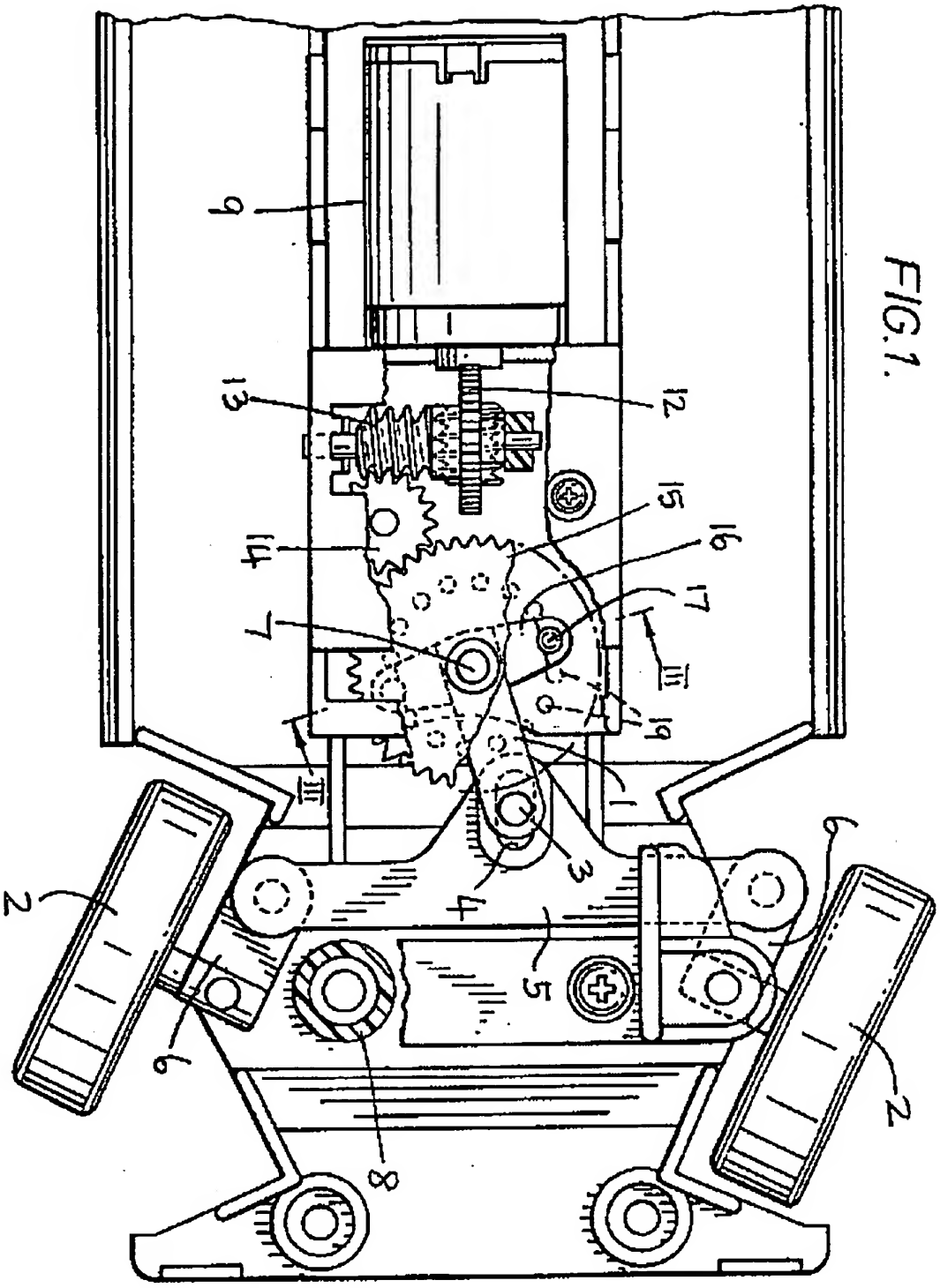
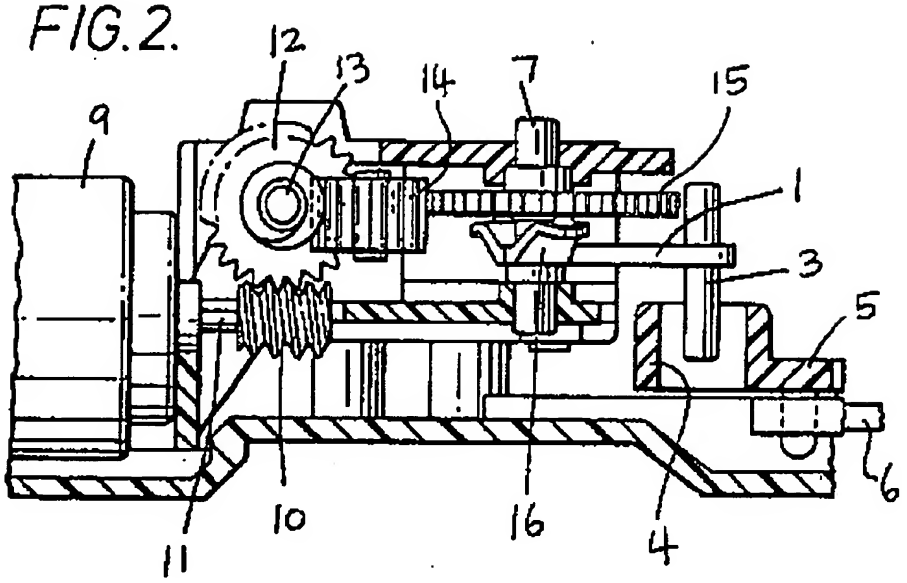


FIG.1.

FIG.2.



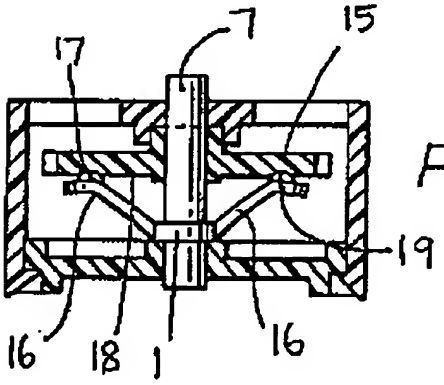
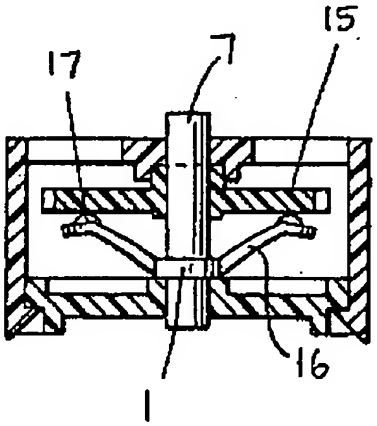


FIG.3.

FIG.4.



SPECIFICATION

Toy vehicle steering mechanism

This invention relates to powered steering mechanisms for toy vehicles and has as its primary object to provide such a mechanism which, as well as permitting a steerable wheel or wheels to be turned through a selectable angle in either direction, also incorporates means for preventing overloading of the mechanism.

According to the invention there is provided a toy vehicle having a powered steering mechanism including a steering arm pivotable through a limited arc to steer at least one wheel of the vehicle, and a reversibly drivable rotary transmission member drivingly connected with said steering arm to selectably pivot the same in either direction of steering operation, the driving connection between the said transmission member and the said steering arm being such that when the steering arm reaches the limit of its pivotal movement in either direction the said driving connection is automatically disengaged to enable further rotation of the said transmission member without further movement of the steering arm, but is automatically reengaged at least when the direction of rotation of the transmission member is reversed.

With such an arrangement, if power continues to be supplied to the said rotary transmission member to rotate the same despite the fact that the said steering arm has reached one of the limits of its pivotal movement, the driving connection between such parts is automatically disengaged, as preventing the mechanism from being overloaded and possibly damaged.

In a preferred form of the invention the said automatic disengagement of the driving connection is effected by a camming action between the said rotary transmission member and drive-receiving means on the said steering arm which means is normally drivingly engaged by the said transmission member. The said rotary transmission member is then preferably formed with at least one opening spaced from its axis of rotation, the said drive-receiving means of the steering arm normally engaging in said opening and the said camming action being effective to disengage the said drive-receiving means from said opening. More preferably, the said rotary transmission member is formed with a ring of said openings centered on its rotary axis, the said drive-receiving means of the steering arm normally engaging in at least one of said openings, and said further rotation of the transmission member causing the said drive-receiving means to automatically engage in the next succeeding opening or openings in the ring. With such a preferred arrangement, unlimited further rotation of the rotary transmission member is possible without overloading the mechanism, as the said drive-receiving means of the steering arm is successively cammed out of engagement with each opening in turn as such further rotation continues. When the rotation of the transmission member is reversed, however, the automatic reengagement of the said drive-receiving means in one or more of the ring of openings readies the mechanism for steering operation in the other direction as soon as is desired.

Preferably the said rotary transmission member is a flat gear wheel, the said ring of openings being formed in a face of the gear wheel between its centre and its toothed periphery. Such a gear wheel may conveniently comprise the final element of a reduction gear train connected to a prime mover for the powered steering mechanism, such as a miniature electric motor, located in the vehicle. In a preferred form of the invention the said reduction gear train comprises, in the order stated, a first worm gear on an output shaft of the prime mover, a flat gear wheel meshing with the said worm gear, a second worm gear fixed to the said flat gear wheel, a pinion gear meshing with the said second worm gear, and the said rotary transmission member meshing with the said pinion gear.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Figure 1 is a plan view of the powered steering mechanism of a toy vehicle according to the invention, with the steering arm nearly at the limit of its pivotal movement in one direction;

Figure 2 is a vertical longitudinal medial cross-sectional view of the apparatus of Figure 1;

Figure 3 is a cross-section on the line III - III of Figure 2, showing the driving connection to the steering arm engaged; and

Figure 4 is a view similar to Figure 3 but showing the driving connection disengaged.

Referring to the drawings, a steering arm 1 is connected to the front wheels 2 of a toy vehicle in a conventional fashion, via a vertical steering pin 3 engaging in a slot 4 in a cross member 5, and linkage members 6. The steering arm 1 is fixed to a vertical shaft 7 journalled for rotation in the vehicle body structure, and the pivotal movement of the steering arm about the axis of the shaft 7 in each direction of steering is limited by the engagement of the forward face of the cross member 5 with pillars 8 of the vehicle body structure, the apparatus being shown in Figure 1 with the steering mechanism nearly at the limit of its right hand steering movement.

Steering movement of the steering arm 1 is powered by a reversible miniature electric motor 9, which drives the steering arm through a reduction gear train comprising a first worm gear 10 on the output shaft 11 of the motor 9, a flat gear wheel 12 meshing with the worm gear 10, a second worm gear 13 fixed to the gear wheel 12, a pinion gear 14 meshing with the worm gear 13, and a final rotary transmission member in the form of a flat gear wheel 15 meshing with the pinion gear 14, the gear wheel 15 being mounted for rotation on the vertical shaft 7 carrying the steering arm 1 so that the gear wheel 15 and the steering arm are rotatable and pivotable respectively about the same vertical axis. The motor 9 is reversibly drivable by a user in any suitable fashion to steer the toy vehicle, for example by a cable connection or by radio control.

The driving connection between the rotary transmission gear 15 and the steering arm 1 is by way of drive-receiving means in the form of a pair of flexible

wings 16 extending in diametrically opposite directions from the shaft 7 and having drive-receiving portions in the form of upstanding protrusions 17. The gear wheel 15 is formed on its underneath flat face 18 with a ring of recesses 19, a diametrically opposite pair of which normally receive the respective protrusions 17 on the arms 16, to enable drive to be transmitted from the gear wheel 15 to the steering arm 1. Thus the wheels 2 are steerable selectably in either direction, to a selectable degree, by operation of the motor 9 in the appropriate direction for an appropriate time, to rotate the shaft 7 and thereby pivot the steering arm 1 to effect steering movement of the wheels.

If, however, the motor continues to be driven in the same direction when the steering mechanism has reached the limit of its movement in one or other direction, the driving connection between the gear wheel 15 and the steering arm 1 is automatically disengaged by the continued rotation of the gear wheel having a camming effect on the protrusions 17 to cam them out of the pair of recesses 19 in which they were engaged, as shown in Figure 4, thus enabling the rotation of the gear wheel to continue whilst the steering arm remains stationary at the limit of its pivotal movement. As the rotation of the gear wheel 15 continues further, the protrusions 17 will click into the next pair of recess 19, and then be cammed out of those recesses in turn. However, when the direction of operation of the motor is eventually reversed, the protrusions will remain in an appropriate pair of recesses to permit steering movement in the other direction. Thus any overload on the mechanism is effectively prevented.

CLAIMS

1. A toy vehicle having a powered steering mechanism including a steering arm pivotable through a limited arc to steer at least one wheel of the vehicle, and a reversibly drivable rotary transmission member drivingly connected with said steering arm to selectably pivot the same in either direction of steering operation, the driving connection between the said transmission member and the said steering arm being such that when the steering arm reaches the limit of its pivotal movement in either direction the said driving connection is automatically disengaged to enable further rotation of the said transmission member without further movement of the steering arm, but is automatically reengaged at least when the direction of rotation of the transmission member is reversed.

2. A toy vehicle as claimed in claim 1, wherein the said automatic disengagement of the driving connection is effected by a camming action between the said rotary transmission member and drive-receiving means on the said steering arm which means is normally drivingly engaged by the said transmission member.

3. A toy vehicle as claimed in claim 2, wherein the said rotary transmission member is formed with at least one opening spaced from its axis of rotation, the said drive-receiving means of the steering arm normally engaging in [illegible] ming action being effective to disengage the said drive-receiving means from said opening.

4. A toy vehicle as claimed in claim 3, wherein the said rotary transmission member is formed with a ring of said openings centered on its rotary axis, the said drive-receiving means of the steering arm normally engaging in at least one of said openings, and said further rotation of the transmission member causing the said drive-receiving means to automatically engage in the next succeeding opening or openings in the ring.

5. A toy vehicle as claimed in claim 4, wherein the said rotary transmission member is a flat gear wheel, the said ring of openings being formed in a face of the gear wheel between its centre and its toothed periphery.

6. A toy vehicle as claimed in claim 5, wherein the said drive-receiving means on the steering arm comprises a pair of drive-receiving portions engaging in two diametrically opposite ones of said openings.

7. A toy vehicle as claimed in claim 6, wherein said drive-receiving portions are resiliently urged to engage in said openings.

8. A toy vehicle as claimed in claim 6 or 7, wherein a pivotal mounting shaft of the said steering arm also mounts the said transmission member for rotation, the said drive-receiving portions of the steering arm being provided on extensions thereof extending radially from the said shaft.

9. A toy vehicle as claimed in any of claims 5 to 8, wherein the said openings are in the form of recesses in the said face of the rotary transmission member.

10. A toy vehicle as claimed in any of claims 5 to 9, wherein the said rotary transmission member is the final element of a reduction gear train connected to a prime mover for the said powered steering mechanism, located in the vehicle.

11. A toy vehicle as claimed in claim 10, wherein the said reduction gear train comprises, in the order stated, a first worm gear on an output shaft of the prime mover, a flat gear wheel meshing with the said worm gear, a second worm gear fixed to the said flat gear wheel, a pinion gear meshing with the said second worm gear, and the said rotary transmission member meshing with the said pinion gear.

12. A toy vehicle as claimed in claim 10 or 11, wherein the said prime mover is a miniature electric motor.

13. A toy vehicle having a powered steering system substantially as hereinbefore described with reference to the accompanying drawings.

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